

## Third Grade Lesson Plan for STEAM Exploration Day

Third grade

This lesson was adapted from

<https://www.sciencebuddies.org/teacher-resources/lesson-plans/how-drones-help-in-farming-elementary#>

Students will discover the science behind how a drone works, explore how drones are used, and program and operate a drone.

### NGSS Alignment

This lesson helps students prepare for these Next Generation Science Standards Performance Expectations:

- **3-5-ETS1-1.** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- **3-5-ETS1-2.** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- **3-PS2-1.** Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- **3-PS2-2.** Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

Materials Needed

### Interest Approach — Engagement:

- Gymnasium or large field free of trees or overhead wires
- Quadcopter drone Tello drone.
- Piece of cardboard, wood, foam, or rubber mat for drone takeoff and landing (optional)

### Activity 1-2: How Does a Drone Fly?

- Hair dryer
- Ping pong ball
- Whirlybird Rotor Template, 2 per student
- Paper clip, 1 per student
- Scissors
- Rulers
- Quadcopter drone
- How Do Drones Fly? Video

### Activity 3-5: Drone Mission

- Gymnasium or large field free of trees or overhead wires
- Brown or black poster paper, 4 pieces
- Quadcopter drone
- Piece of cardboard, wood, foam, or rubber mat for drone takeoff and landing (optional)
- tablet
- Tello app



#### Interest Approach - Engagement

1. Take the class to a gymnasium.
2. Show the students the quadcopter drone. Explain that drones either have fixed wings or rotors. Drones with four rotors are called quadcopters.
3. Perform a demonstration of the drone's capabilities including take off, hover, maneuvers in the air, filming video, taking photographs, and landing. (If flying the drone outside, a cardboard, wood, foam, or rubber landing pad is recommended. Long grass can interfere with the drone's rotors.)
4. Arrange the students into small groups. Ask the groups to make a list of different ways in which a drone might be useful to people.
5. Have each group share their ideas with the class.
6. Explain to the students that, in this lesson, they will discover how a drone flies, explore how to operate a drone.

#### Procedures

##### Activity 1: How Does a Drone Fly?

1. Ask the students, "How do drones fly?" After listening to their responses, lead a discussion about gravity and lift. Integrate the following points into the discussion:
  - a. Gravity is the natural force that causes things to fall toward the Earth.
  - b. Lift is the force that directly opposes the weight of the aircraft and holds the aircraft in the air.
  - c. Quadcopter drones use rotors to help the drone lift off the ground and fly.
  - d. As the rotor pushes down on the air, air pushes up on the rotor.
  - e. In order for the drone to fly into the air, a force that equals or exceeds the force of gravity must be created. This is called lift.
  - f. The faster the rotors spin, the greater the lift.
2. Turn on a hair dryer and aim it towards the ceiling. Place a ping pong ball into the stream of air. Ask the students, "Why is the ping pong ball floating?" (*The force of the air pushing up on the ball is equal to the force of gravity pushing down on the ball, so the ball is hovering in the air.*)



3. Ask the students what they think will happen to the ping pong ball if the hair dryer is turned off. Turn the hair dryer off to show the students that the ball will fall to the ground. Ask the students, "Why does the ping pong ball fall when the hair dryer is turned off?" (*The force of the air pushing up on the ball is less than the force of gravity pushing down on the ball.*)
4. Hand out two copies of the whirlybird rotor template and a paper clip to each student. Instruct the students to cut out both of the whirlybird rectangles. Have them crumple one of the rectangles into a ball and follow the template's instructions to make a rotor with the other piece of paper.
5. Have the students carefully stand on their chairs and drop their crumpled ball and their rotor (paper clip facing down) at the same time from the same height.
6. Ask the students, "Which stayed in the air the longest, the crumpled ball or the rotor?" (*the rotor*) "Why did the rotor stay in the air longer?" (*The design of the rotor causes the blades to spin as it falls through the air. The spinning blades generate enough lift to slow the rotor down.*)
7. Show the students the rotors on the quadcopter drone. Clarify that, unlike the paper rotor, the drone's rotors are powered by motors that can create and maintain a force that is equal to or greater than the force of gravity. The rotors help the drone lift off the ground and fly.
8. Fly the class drone using a tablet as a remote control.

### Activity 3-5: Drone Mission

1. Prior to beginning *Activity 3*, use gymnasium to represent an outside playground. Place four pieces of poster paper onto different spots on the gymnasium floor (This will represent the outside playground.)
2. Model for the students how to video the gymnasium field by flying the drone around the rectangular perimeter of the "school playground" using the following manual commands:
  - Turn on the Drone video.
  - Begin takeoff in the bottom left corner of the rectangular field.
  - Yaw right 90°.
  - Fly left to the top left corner of the field.
  - Yaw right 90°.

- Fly left to the top right corner of the field.
  - Yaw right 90°.
  - Fly left to the bottom right corner of the field.
  - Yaw right 90°.
  - Fly left to the bottom left corner of the field.
  - Land in the bottom left corner of the field.
  - Turn off the drone video.
3. Organize the class into groups of two students. Have the groups use the video footage to fly the drone.
  4. Manually using a remote-control tablet, the flight path should meet the following requirements:
    - The drone may begin at any location along the perimeter of the field.
    - The drone must take off and land at the same location.
    - The drone's camera must face the gym throughout the flight. (Students will not have the ability to capture video or photographs during the programmed flight.)
    - The drone must fly around the entire perimeter of the gym one time.
  5. Allow time for each group to test their flight plan by launching their mission around the gym.
  6. Have each group take turns manually flying the drone over the “outside playground.” Do this for two days ending with the last day outside on the playground. Have a poster board for each landing spot.

### Concept Elaboration and Evaluation

After conducting these activities, review and summarize the following key concepts:

- A drone is an unmanned aircraft guided by remote control or onboard computers.
- In order for a drone to fly into the air, a force that equals or exceeds the force of gravity must be created. This is called lift.

### Vocabulary Words

**drone:** an unmanned aircraft guided by remote control or onboard computers

**force:** a push or a pull on an object

**Global Positioning System (GPS):** a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth

**gravity:** the natural force that causes things to fall toward the Earth

**hover:** remain in one place in the air

**lift:** the force that directly opposes the weight of an aircraft and holds the aircraft in the air

**pitch:** movement of a drone up or down on a lateral axis

**propulsion:** the force that moves something forward

**quadcopter:** a drone with four rotors

**remote control:** a device used to control machines from a distance

**roll:** rolling movement of a drone sideways left or right on a longitudinal axis

**rotor:** a set of rotating blades that turn around a central point and lift an aircraft off the ground

**satellite:** a spacecraft placed in orbit around the Earth, moon, or another planet used to send signals and information as part of a communications system

**thrust:** the force that causes an aircraft to move forward

**yaw:** rotating movement of an aircraft clockwise or counterclockwise on a vertical axis